

#### ABSTRACT OF THE DISCLOSURE

The invention relates to carbon deposition by decomposing gaseous compounds with the aid of the SHF discharge plasma and can be used, for example, for producing polycrystalline diamond films (plates), which are used for producing output windows of power SHF sources, for example gyrotrons. Said invention ensures a high speed deposition of the high quality diamond films (having a loss-tangent angle  $\square$  equal to or less than  $3 \times 10^{-5}$  on supports whose diameter is equal to or higher than 100 mm. For this purpose, a SHF discharge is initiated in a gas mixture which is arranged in a reaction chamber and contains at least hydrogen and hydrocarbon. Afterwards, said gas mixture is activated by producing a stable nonequilibrium plasma with the aid of SHF radiation having a frequency  $f$  which is many times higher than a commonly used frequency of 2.45 GHz, for example 30 GHz. In order to localize the plasma, a standing wave is formed near the carrier and plasma layers are formed in the antinodes thereof in such a way that the sizes thereof are adjustable.